agricultural research

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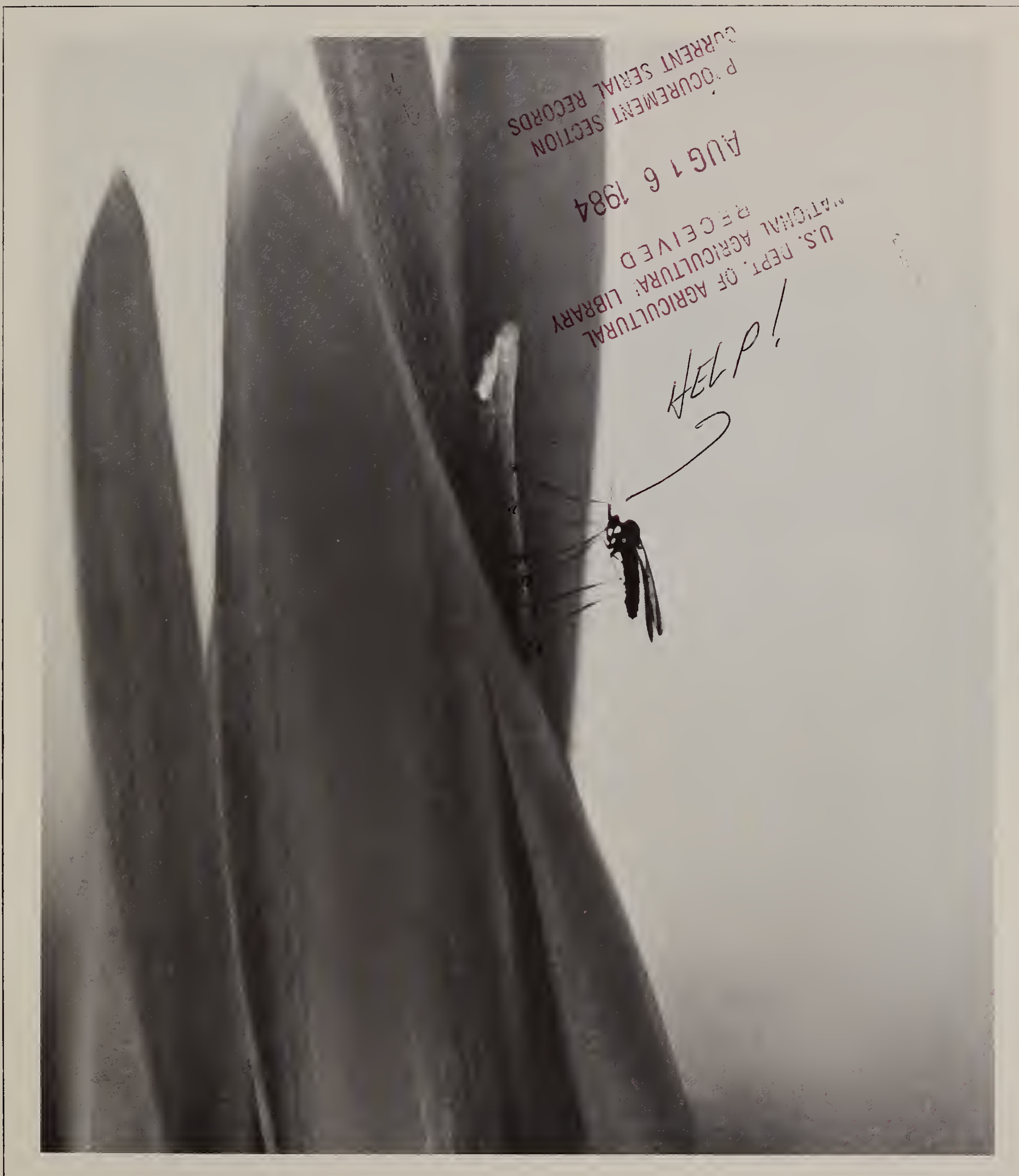

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July 1976/Vol. 25, No. 1

Country Livin': Where It's At

These days, rural America is where it's at. Across the nation, rural areas and towns are being revived.

The renewed growth and vigor of rural America is one of the most dynamic population news stories today. During the first 4 years of this decade, 1.6 million more people moved to the nation's nonmetropolitan areas than moved away from them.

The enrollment in agricultural colleges is up. Record numbers of students are taking vocational agriculture courses in high schools. Twice as many college graduates are now returning to the farm as did 10 years ago.

Rural America is enjoying this vigor—stores and farms are expanding. Industry is moving to rural areas. And, millions of people trapped in the city dream about moving to the country.

Time was, when rural folks were isolated, out of touch, not quite "with it." Today, however, improved transportation, communications, and other modern conveniences have eliminated forever the image of a backward rural America.

Machines and technology have replaced muscle, ox, mule, and horse power on the farm. Modern equipment, developed by agricultural scientists, can do as much work in one hour as our grandparents could do in a week.

Machines now harvest our wheat, oats, citrus, tomatoes, cherries, grapes, blueberries and even cucumbers. Containerized vans move produce from the farm, over land, sea and air, without time-consuming unloading and repacking along the way, to overseas markets.

And modern agricultural research has increased production per acre beyond George Washington's wildest dreams.

The modest potato, for instance, averaged only about 80 bushels per acre in the late 1800's. Production slowly crept up to 120 bushels per acre. Between 1910 and 1920, however, USDA scientists began to study potato breeding. It took until the late 1940's for this research to pay off—yields jumped to nearly 300 bushels per acre.

The immense progress in American agriculture bears testimony to what agricultural research can do. This, coupled with the renewed growth of rural America, is one of the most exciting success stories of our Bicentennial Year.—*M. M. M.*

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COVER: An adult Hessian fly, *Mayetiola destructor* (Say), perches on a seedling wheat plant in studies to determine the genetics of virulence in Hessian flies (0476X350). Article begins on page 3.

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Earl L. Butz, Secretary
U.S. Department of Agriculture

Talcott W. Edminster, Administrator
Agricultural Research Service

They fend off insects

FARMERS SAVE about 10 million bushels of wheat each year by planting varieties that resist the Hessian fly. Agricultural researchers who helped achieve the savings are working with nature further to control the Hessian fly and another serious pest, the cereal leaf beetle, which now infests most of the eastern soft wheat region.

In research aimed primarily at developing new resistant varieties of wheat, ARS entomologists and agronomists at the Purdue Agricultural Experiment Station, West Lafayette, Ind., are gaining spinoff information that may help them develop additional technologies for controlling insects.

Dr. Foster seeds 4-inch pots with wheat of different sources of genetic resistance. These wheats will determine the genetic phenotype of a specific Hessian fly biotype (0476X349–15).

Hessian fly. Developing wheat varieties that are resistant to the mosquito-like insect that sucks sap from stems of wheat remains an unrelenting task, says ARS entomologist Robert L. Gallun (Department of Entomology, Purdue University, West Lafayette, Ind., 47906). New races of Hessian fly are constantly developing in nature.

With researchers of Purdue and other State experiment stations, the ARS scientists forecast development of new races and, for experimental purposes, actually produce them in the laboratory. These new races serve as a tool for testing resistance in breeding lines of wheat. Then, from the resistant breeding lines, agronomists develop new varieties that hopefully become available for farmers to plant before the new races become destructive in nature.

While exploring genetic relationships between Hessian flies and wheat lines, ARS entomologist John E. Foster and Dr. Gallun are conducting feasibility studies on using Hessian flies to suppress or eradicate their own numbers—autocidal control. "We believe the concept may prove practicable in isolated areas where soft wheat varieties may become susceptible to new races of Hessian fly," says Dr. Gallun.

Autocidal control is based on a dominant genetic characteristic of Hessian flies of the Great Plains race (AGR. RES. February 1970, p. 6). Neither they nor their offspring can survive more than 3 days on most soft wheat varieties. The scientists, having developed technology for rearing Great Plains flies in a greenhouse, are releas-

Miss Achara Prompichai, a doctoral candidate in entomology at Purdue University who specializes in research on how leaf pubesence affects insects other than the cereal leaf beetle, plants individual wheat seeds for a randomized test to measure the effect of different levels of pubescence on the biology of the Hessian fly (0476X349–20).

Michigan State and Purdue Universities along with ARS and USDA's Animal Plant and Health Inspection Service (APHIS) are cooperating in research on the impact of resistant wheat on the population dynamics of the cereal leaf beetle. Dr. Gallun, research leader, locates wheat fields on aerial photos of the pilot research areas in southern Michigan and northern Indiana (0476X352–13).

ing them in masses to mate with Hessian flies of other races in soft wheat.

In studies preliminary to this experiment, the research team developed mathematical equations to determine ideal numbers of insects to be released. After confirming the validity of the equations through laboratory experiments, they also had to develop a method for estimating native populations of Hessian flies in the field.

For every 1 native Hessian fly at an experimental field site, the scientists have released about 20 Great Plains flies for each of 2 generations of matings that occur each year. In the first year, Hessian fly populations have declined by 20 to 30 percent in the release area, says Dr. Gallun.

In other research, ARS agronomist John J. Roberts and Dr. Gallun found that masses of leaf hairs (pubescence) on wheat hinder Hessian fly larvae from migrating to the base of the plant beneath the soil surface where pupae, called flaxseeds, develop. Earlier, ARS scientists at East Lansing, Mich., and Lafayette had learned that the hairy leaves are an inhospitable place for oviposition (egg laying) and development of cereal leaf beetles. Dr. Roberts and his colleagues found that populations of oat bird cherry aphids also failed to multiply greatly on a line of pubescent wheat.

Cereal leaf beetle. The small grain breeding team has developed strains of wheat with leaf pubescence that reduces cereal leaf beetles' oviposition and larval feeding by 99 percent. They also bred resistance to leaf rust into the strains.

Building resistance to cereal leaf beetle in grain is work which researchers started as recently as 1962 when the pest was first discovered in the United States. Since then, the beetle has spread eastward and southward from southwest Michigan into at least 13 other States and Ontario. Although it prefers oats and barley, the beetle has reduced wheat yields as much as 23 percent in some fields.

Most research on cereal leaf beetle is conducted at the ARS Cereal Leaf Beetle Research Laboratory at East Lansing, Mich. ARS scientists are cooperating with scientists at Purdue and Michigan State Universities in studies on combining resistance to Hessian fly and cereal leaf beetle in the same wheat varieties.

The Purdue Agricultural Experiment Station, in cooperation with ARS, has released the first two selections of wheat germplasm with resistance to cereal leaf beetle. They are called Vel and Fuzz. A new variety release is being planned for plantings by certified seed growers next fall. Thousands of wheat strains are presently under evaluation for resistance to the cereal leaf beetle.

In a research project just getting underway in a 16-square-mile area of southern Michigan and northern Indiana, farmers are growing Fuzz and Arthur wheats in separate fields. ARS and State scientists will be studying effects of pubescent wheats on cereal leaf beetles and beneficial insects.

Research payoffs. Dr. Gallun expresses optimism about further progress that entomologists and plant breeders may make as they seek to control Hessian flies, cereal leaf beetles, and other pest insects. From past studies, he notes that for every dollar invested in developing plant varieties resistant to Hessian fly, European corn borer, and the spotted alfalfa aphid, about $300 has been saved in crop losses.

The only expense farmers incur by planting resistant varieties is the cost of seed, Dr. Gallun maintains. There are no insecticides to contend with or residues that may prevent the selling of their crops. "The amazing thing is that the plant does the control job itself," he says.—*G. B. H.*

Yield studies are performed to measure the damages inflicted by Hessian fly populations of varying infestation levels. Dr. Foster checks plots established on the Purdue Agronomy Farm (0476X349–29).

Dr. Roberts examines experimental, mature wheat plants for pubesence that deters oviposition, or egg laying, by the cereal leaf beetle (0476X349–2).

Toward Petroleum Substitutes

SOYBEANS, a prime commodity in U.S. export sales, and silicon, an element second only to oxygen in abundance, may become a winning team in helping solve the energy problem. The approach taken is the old one, trying to substitute an abundant, replaceable agricultural raw material for a dwindling, irreplaceable resource, in this case: petroleum.

Working on an ARS-sponsored project to increase the industrial uses of soybean oil, Israeli scientists have experimented since 1971 with the addition of silicon compounds to the long chain unsaturated fatty acids of this oil.

Silicon, by nature of its properties, conveys stability to the versatile industrial uses of organic polymers. The resulting silicone polymers may impart properties of low temperature flexibility, high temperature tolerance, low surface tension, high degree of slip or lubricity, chemical and physiological inertness, and weather resistance. Such properties greatly enhance the value of these polymers for lubricants, dielectrics, insulation, shock resistant pads, and protective coatings.

For example, silicone rubbers serve as insulation for power cables and high-voltage lead wires. Parts such as seals, grommets, O-rings, and converter plugs are also molded of silicone rubber. Silicone foams can withstand a broader range of service temperatures than any other elastomeric foam.

ARS-cooperating scientist William R. Miller, Northern Regional Research Center (1815 North University St., Peoria, IL 61604) says the Israelis worked primarily with oleic acid, one of the principal unsaturated fatty acids of soybean oil.

The Israelis initially studied the reactions of chloromethylsilanes with methyl esters of oleic acid. Chloromethylsilanes are commercially produced precursors of the silicones, which are defined as semiorganic polymers.

These polymers are based on a skeleton structure of alternate silicon and oxygen atoms with various organic groups, such as the methyl groups, attached to the silicon atoms. "The purpose of the methyl esters was to replace glycerol from the oleic acid with methyl alcohol—a more simple compound, more easily handled and, therefore, more predictable in a chemical reaction and more easily characterized," Dr. Miller says.

Through subsequent chemical reactions, the Israelis developed several potentially valuable organo-silicon polymers:

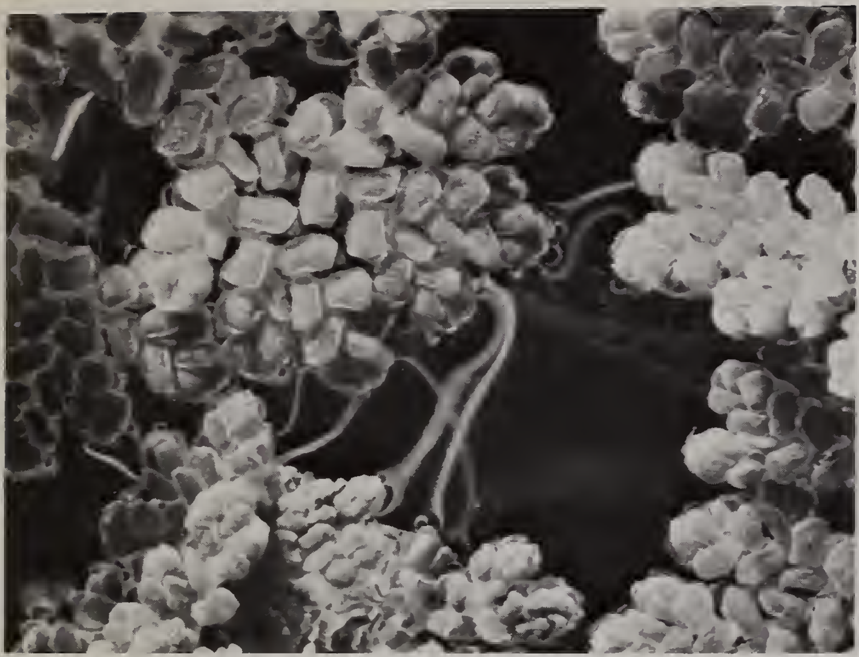
- film-forming polyurethanes (potential for making coatings, urethane foams);
- polysiloxanes (potential for making plastics and rubber-like compounds); viscous polyesters; and
- an elastomeric-type rubbery compound.

The Israelis also developed a dibasic acid compound, which has properties for reducing surface tension of water (potential for cosmetics, wetting agents, detergents).

Dr. Miller says that besides adding to the fundamental knowledge of fatty acid chemistry, this project has considerable economic value for U.S. agriculture. "Although the Israelis did not evaluate commercial applications of the polymers or completely characterize the products of these chemical compounds, this project puts ARS research squarely on the drawing board for developing silicon-containing products that would result in increased utilization and upgrading of soybean oil," he says.

This Public Law 480 project was conducted under the direction of Dr. N. Saghian and Dr. D. Gertner at the Hebrew University, Jerusalem.—*M. C. G.*

Silicon composes a major portion of sand, sandstone, quartz, silicon rocks, clay, granite, and many other common minerals. The physiological effects of methyl silicone fluids have been examined in some detail, and the compounds appear to be free of harmful properties. The absence of toxic effects suggests that the fluids may be used as laxatives in place of mineral oils, since they do not dissolve the oil-soluble vitamins, and as nonaqueous vehicles for the intramuscular administration of drugs.



In studies to find natural sources of nitrogen through photosynthesis, scientists have caused a microscopic alga growing in the leaves of this water fern to release hydrogen from water and fix nitrogen from the air (0376X254–4).

Fertilizer and fuel from tiny plants?

A PLANT growing in the leaves of another can produce elements for fuel and fertilizer. In an exploratory ARS study, a microscopic alga growing in the millimetric-sized leaves of a water fern, uses light energy to release hydrogen from water and to fix nitrogen from the air.

Hydrogen, the lightest element, yields more energy on a weight basis than any other oxidizing (nonnuclear) fuel. Nitrogen, an element essential to all plant and animal life, frequently must be added to soil or other growing medium as fertilizer for the adequate growth of plants.

In research to find natural sources of nitrogen and thus conserve petroleum used in the synthesis of fertilizer, biochemist Jack W. Newton found an energy bonus. He induced the nitrogen-fixing, blue-green alga, *Anabena azolla,* to release hydrogen from water in laboratory glassware at the Northern Regional Research Center (1815 North University St., Peoria, IL 61604).

Dr. Newton says this is the first biologically stable system for producing hydrogen from water by photosynthesis. Other systems depending on algae or bacteria require something in addition to water as a source of hydrogen. Systems depending on enzymes and chloroplasts (chlorophyll-containing organs) are unstable. They are damaged by oxygen and quit working.

In nature, the alga, *A. azolla,* grows in a leaf cavity of the fern, *Azolla.* The alga, containing nitrogenase, a nitrogen-fixing enzyme, as well as chlorophyll, takes nitrogen from the air and hydrogen from water and releases oxygen. The nitrogen and hydrogen are combined as ammonia (NH_3) in the fern leaves. Photosynthesis provides the energy for these activities in both alga and fern.

Dr. Newton diverted the alga-fern symbiosis from producing ammonia to releasing hydrogen by two techniques. First, he grew the water ferns in a solution containing a nitrogen fertilizer, making nitrogen fixing from the air unnecessary. Second, he incubated the algae (both in intact ferns and in extracts) in nitrogen-free atmospheres, making nitrogen fixing impossible. With ammonia production unnecessary, impossible, or both, the alga-fern system releases hydrogen.

Algae in ferns grown with fertilizer and in an inert atmosphere of argon gas "evolve molecular hydrogen at rates comparable to their total nitrogen-fixing activity," says Dr. Newton. Algae in unfertilized ferns and inert atmosphere produce less than a third as much hydrogen as algae in fertilized plants and inert atmosphere. Algae in fertilized ferns and nitrogen atmosphere or air, the experiments show, produce even less hydrogen.

No hydrogen was produced from nitrogen-fertilized or unfertilized ferns in the dark or from ferns freed of alga plants by prolonged fertilizing and antibiotic treatment.

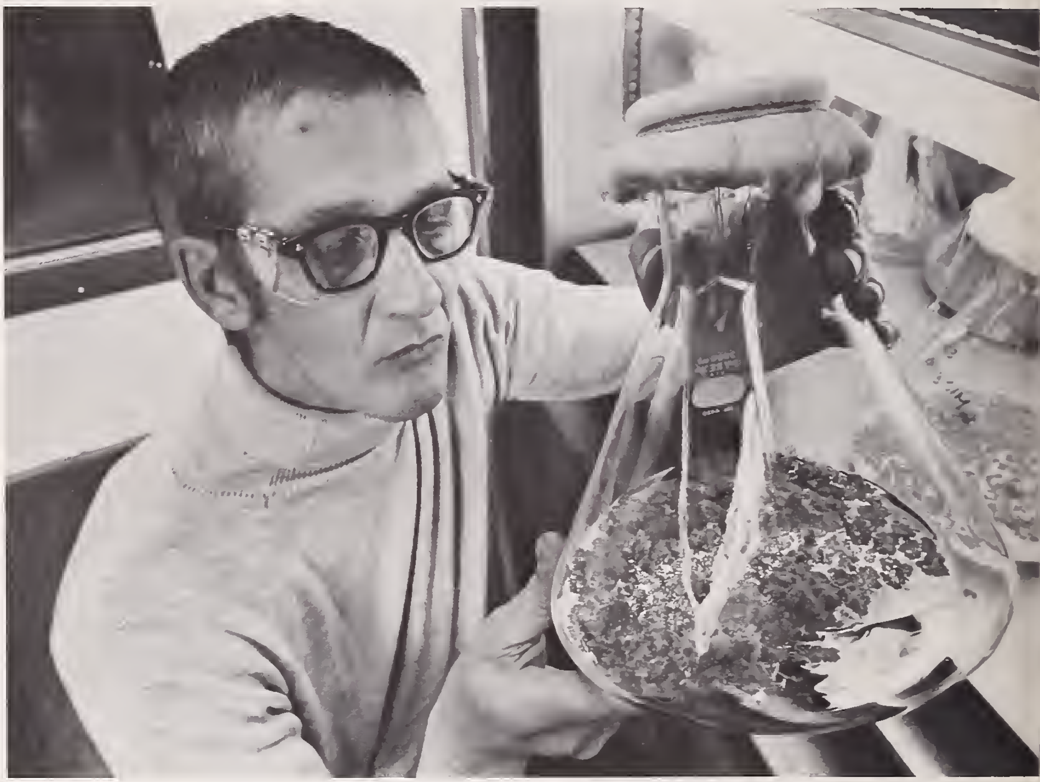
Hydrogen production in 15-milliliter (0.51-oz) flasks in the study was in nanomole quantities (billionths of the gas equivalent of 2 g) per hour per gram of fern. Production remained constant at least 24 hours.

Although small scale and low rate, the laboratory production shows that the alga-fern system needs only water as a hydrogen source and is not self-limiting. The association with the fern appears to protect the alga plants from damage by oxygen, ammonia, and nitrogen fertilizer.

If hydrogen is to be considered as a fuel, Dr. Newton says the alga-fern symbiosis is "particularly attractive as a system for biological production."—*D. H. M.*

Nature's generator

Dr. Newton inspects laboratory flasks of intact water fern propagating in a plant growth chamber. The ferns will be used in further experiments (0376X256–11A).



Researchers first began studying Anabena azolla *as an energy source after viewing photomicrographs of alga bundles with their protected egg-shaped structure within the leaf, a structure implying the stability necessary for production of hydrogen (0376X253–3A).*

Dr. Gerald W. Strandberg is seeking ways of producing hydrogen on a large yield basis through photosynthesis as part of a broad project to find replacements for fossil fuels. Here, he produces blue-green algae by fermentation and photosynthesis to feed a secondary fermenter-synthesizer which, in turn, serves as a hydrogen generator (0376X259–3).

Production of hydrogen through photosynthesis is determined by introducing argon gas into vials containing either digested or undigested water ferns. Chemist Nora Zorick removes gas samples from the vials; they are then assayed for hydrogen content through gas chromatography (0376X257–24).

To solve the problems related to grain dust—fiber, explosions, and health hazards—researchers are studying the characteristics of dust and measuring the amounts of dust present. These amounts vary with the type of grain and the methods employed in handling it (1175X2282–11).

The grain dust problem

SEVENTY PERCENT of the dust generated from handling corn at a grain elevator was of a size to be airborne as a potential pollutant. Five percent of the particles may have been small enough to be inhaled; 1 in 62 particles collected when moving visibly moldy corn was a mold spore.

These observations help define the problems to be solved in designing more efficient systems for dust control when grain is handled. Each handling of grain produces dust, and grain for export may be moved 12 to 20 times.

Dust control in grain elevators has long been a concern because of fire and explosion hazards and the labor needed in housekeeping. Legal requirements for controlling air pollution and protecting workers' health further emphasize the urgency of more effective control systems. Typical cyclone dust separators in use may remove no more than 80 percent of the smallest particles, including storage mold spores, that do not settle out of the air readily. Inhaling dust when handling moldy or heating grain may produce farmer's lung

disease or heating grain syndrome in workers.

ARS agricultural engineer Charles R. Martin and plant pathologist David B. Sauer in studies at the U.S. Grain Marketing Research Center (1515 College Ave., Manhattan, Kans. 66502) found that both the kind of grain and the handling operation affect dustiness. A cyclone separator removed the equivalent of 0.1 percent of the weight of corn as dust in single handling. Dust weight increased to 0.5 percent when the corn was cleaned during handling. Moving wheat once produced only 0.009 percent of its weight as dust.

Less than 50 percent of the wheat dust, in contrast with 70 percent from corn, was small enough to be airborne, the major concern in plant housekeeping and air pollution control. The proportion of dust small enough to be inhaled, a potential factor in health of workers, was four to five times as great in corn as in wheat. The 1 to 2 percent oil in corn dust was enough to make fine particles too sticky for easy separation from the grain by cleaning or sieving.

The researchers found a higher concentration of storage fungi spores in dust collected by the separator than in grain, but an even higher amount of the spores in dust exhausted into the air than in collected dust. The total number of spores decreased with subsequent handlings of corn moved three times. The exhaust dust remained high in spore content.

The study indicated that cyclone separators put an extremely high number of spores into the atmosphere when handling even moderately mold-damaged grain. Some 20 to 30 billion spores were released every minute in the tests. A larger, higher speed facility handling moldier grain could easily discharge 10 times as many spores, Dr. Sauer suggests. Mold spores discharged into the air may contaminate other stored grain or growing crops as well as affect human health.—*W. W. M.*

New era in insect control

A NEW ERA in the chemical control of insects may be opening with the utilization of substances that prevent the hatch of eggs or interfere with the development of insects.

Tests by ARS entomologists James E. Wright, Robert L. Harris, and biological technician George E. Spates at the Veterinary Toxicology and Entomology Research Laboratory (College Station, TX 77840) show that an insect growth regulator or reproductive inhibitor sterilizes flies and may very likely open a new dimension in insect control.

The substance recently tested and found very effective against the stable and horn fly is TH–6040, or dimilin (AGR. RES., Aug. 1975, p. 11). Also useful against the common housefly, this chemical need only be applied to surfaces, like walls, where the fly lands and rests, to be effective against some species. It can also be transmitted by contact from the male to the female fly.

The possible advantages of a chemical insect sterilant that is effective by surface contact are many. It could offer an alternative to the effective but expensive and cumbersome method of mass rearing and sterilizing of insects to mate with fertile insects in nature to reduce populations. In some cases, the substance could be applied to the walls of barns or houses to achieve easy and cheap fly control.

One intriguing possibility is that the chemical could be incorporated into paint as fungicides are now. Then, stable and houseflies might be eliminated from barns and houses with no effort from the homeowner. Storage and application problems would be eliminated as well as the threat of contamination to food, pets, and people.

In the case of the horn fly, which spends most of its time on the body of host cattle, dimilin must be applied directly to the animal to be effective. A single application of dimilin to a host steer in these studies produced nonviable horn fly eggs for 5 weeks.

The stable fly, on the other hand, spends much of its time on the walls of stables and barns. Thus, it can be best treated by the application of the chemical to the surfaces where the fly rests. In one test, less than 1 percent of the eggs of stable flies hatched when exposed for 2 hours to dimilin-impregnated paper.

The chemical dimilin operates by interfering with the biological development of the insects before they hatch. Thus, the action of the chemical is considered "reproductive inhibition" or sterilization. This inhibition of the biological process is probably what causes the eggs to not hatch. If the eggs do hatch, the chemical interferes with the insect's ability to make chitin (the horny substance that forms the creature's outside) from glucose and thus develop properly into an adult.

TH–6040 was recently registered by the Environmental Protection Agency for use against the gypsy moth. However, it's use against other insects is still experimental.— B.D.C.

One of the machines used for deep plowing sodic soils is this large disk plow which is turning over about 2 feet of soil on a farm near Belfield in North Dakota. (PN–582).

Sodic soils respond to deep plowing

PLOWING sodic claypan soils 24 to 30 inches deep produced dramatic increases in small grain production in North Dakota. In 9 years of testing, deep-plowed plots averaged 9 bushels per acre more wheat, a 30-percent increase, compared to plots conventionally plowed 5 to 6 inches deep in tests by soil scientist Fred Sandoval and coworkers at the Northern Great Plains Research Center (Box 459, Mandan, ND 58554).

Sodic claypan soils are a serious agricultural problem on more than 20 million acres in the northern Great Plains of the United States and Canada. About 2.5 million acres, or more than 10 percent of the soils of western North Dakota are sodic, that is, contain an excess of sodium ions. About 14 million acres of farm land are so affected in Montana, Wyoming, and South Dakota as are more than 10 million acres in the Canadian prairie provinces.

The soil condition is commonly called claypan, scab land, and gumbospot land, and typically shows up as randomly distributed, slightly depressed, semibarren or bare spots. The affected land presents serious problems in seeding and tillage operations. In the experimental sites studied in western North Dakota, the soils are identified as Rhoades or Belfield series (Natriborolls).

The primary problem produced by sodic soils is water stress on crops. The claypan layer, which usually occurs near the surface, is a barrier to water infiltration and root growth. The layer is a dense, fine-grained sodic material, and when at the surface, tends to puddle when wet and forms a hard crust when it dries. This condition sometimes presents seed emergence problems when rain follows planting. Water infiltration and storage is inhibited and therefore soil water is unavailable to plants. Because the lower part of the claypan is moderately saline, salinity also directly affects plants by preventing water uptake. As a result, many sodic claypan soils are used as hayland and not cultivated. Others are cultivated but are very unproductive because of their poor soil water availability.

In test plots near Mandan, small grains on the check plots headed and matured prematurely because of water stress. The crop growing on deep plowed plots, in contrast, produced more tillers and made more growth before heading. This resulted in later maturing, and more numerous and larger grain heads.

The deep-plowing treatment does at least two things which change the soil condition, Mr. Sandoval said. Deep plowing breaks up the sodic layer and mixes in native soil gypsum (calcium

sulfate) which occurs below the dense layer.

The broken sodic layer, mixed with gypsiferous subsoil, lets more water enter the soil. Density decreases and permeability increases, and calcium from the gypsum replaces the sodium in the soil. Practical benefits are increased water holding capacity, better root penetration, and improved water availability to the plant. Also, leaching can now take place, tending to move sodium below the root zone.

Mr. Sandoval's measurements of the soil water show that more water enters and is stored in the soil following deep plowing. Furthermore, more water is removed from the soil by small grain crops. Three-year averages showed that small grains extracted 4.1 inches of stored soil water per growing season from deep plowed plots. Small grains grown on plots plowed 6 inches deep removed only 2.9 inches of water.

Mr. Sandoval also experimented on nine field plots on land owned by farmer cooperators. Results on these plots have shown that yields of small grains ranged from 6 to 18 bushels more per acre on deep plowed land than on check plots. His farmer cooperators are convinced that deep plowing significantly increases crop production on sodic claypan land. Indeed, in 1974 and 1975 the cooperators deep plowed 15 fields totaling nearly 300 acres.

"At least two farmers are buying big plows and plan to deep plow their sodic claypan soils," Mr. Sandoval said.

The treatment seems to be permanent. Following these tests, the research plots are still improving in grain production as the sodium continues to leach out and soil-water relationships improve. The large increase in productivity, increases the potential value of the land. Cost of deep plowing is about $30 to $35 per acre, depending on the type of plow used, the size of the area plowed, and the specific soil conditions.—*R. G. P.*

Soil scientist James Power examines a typical sodic soil "claypan" sample which is so strongly sodic that nothing will grow on it (0673W1239-17).

Mr. Sandoval examines wheat growing on a plot of sodic soil plowed 6 inches deep. The wheat has been forced to head prematurely by water stress which will reduce yield. Wheat on adjacent plots plowed 24-inches deep is still in a vegetative stage storing energy which will be converted to grain (0673W1239-4).

SCIENTISTS HONORED

For their outstanding achievement, six individuals and three groups of ARS employees recently received Distinguished and Superior Service Awards. Secretary of Agriculture Earl L. Butz presented the awards at USDA's 30th annual awards ceremony May 25 in Washington, D.C.

Dr. Steven C. King, Deputy Director of the Northeastern Region (PN-4115).

DISTINGUISHED SERVICE:

Dr. William H. Allaway, director of ARS's U.S. Plant, Soil, and Nutrition Laboratory, Ithaca, N.Y., for leading and motivating ARS scientists and contributing to the understanding of trace element relationships in soil, plants, and animals—with major impact on human and animal nutrition.

Dr. John R. Gorham, veterinary medical officer and research leader, Pullman, Wash., for creative personal research and inspiring leadership that resulted in solutions to problems of animal disease control and basic knowledge of viral and genetic disease of animals and humans.

Dr. Steven C. King, deputy administrator Northeastern Region, Beltsville, Md., for initiating and directing an innovative, effective system to improve the status of minority and women employees.

Absorbent Polymer Research Group, Peoria, Ill., for discovering and developing superslurper—a starch product with unique water holding properties that can be used in problem soils, seed and root coating formulations, and absorbent disposable soft goods. Led by Dr. William M. Doane, the group also included: Dr. Edward B. Bagley, Roger A. Eisenhauer, Dr. George F. Santa, Dean H. Mayberry, Dr. Charles R. Russell, Dr. Neil W. Taylor, and Ms. M. Ollidene Weaver.

SUPERIOR SERVICE:

Leonard J. Erie, agricultural engineer, Phoenix, Ariz., for applied research and development of practical irrigation systems and management techniques of current major significance to the United States and to world irrigation.

Howard L. Hyland, principal plant introduction officer, Beltsville, Md., for outstanding contributions in introducing and exchanging valuable plant germplasm throughout the world for use in crop improvement programs.

Dr. Donald E. Moreland, research leader, Raleigh, N.C., for discovering that many herbicides selectively kill weeds by interfering subcellularly with the photochemical and oxidative production of energy required to support their fundamental life processes.

Research Group on the Inactivation of Aflatoxins by Ammoniation of Cottonseed Meal, New Orleans, La., for research in developing a practical ammoniation process for inactivating aflatoxins in cottonseed meal, thus retaining feed markets and protecting both human and animal health. Led by Frank G. Dollear, the group also included: Dr. Albert N. Booth (retired), Louis P. Codifer, Homer K. Gardner, Jr., Dr. Leo A. Goldblatt (retired), Dr. Daniel H. Gould, Dr. Michael R. Gumbmann, Stanley P. Koltun, Dr. Godfrey E. Mann (deceased), Dr. Merle S. Masri, Eric T. Rayner, Miss Dorothy J. Robbins, and Henry L. E. Vix (retired).

Sweet Sorghum Research Team, Weslaco, Tex., for developing the technologies for successful factory-scale sugar production from sweet sorghums. Lead by B. Ashby Smith, other team members are: Bruce J. Lime, W. Raymond Cowley, Kelly C. Freeman, Robert C. Smith, Robert V. Romo, Richard A. de la Cruz, Jose J. Molina, Raul Rivera, Dr. Sim A. Reeves, Jr., and Robert C. Dillon.

AGRISEARCH NOTES

Four good ones

IF AT FIRST you don't succeed . . . . It took some doing, but ARS has produced not one but *four* new tomato varieties that are resistant to curly top virus disease. These new varieties represent a major step toward a viable commercial tomato industry in the desert regions of the Intermountain West.

Curly top is the same disease that nearly wiped out the West's sugar beet industry in the early 1900's. The virus, which is spread by the sugar beet leaf hopper, has long prevented tomatoes from becoming a significant commercial crop in the Pacific Northwest and the Intermountain West.

It is believed that curly top interferes with metabolism, cell division, and the plant's food distribution system. Plants stop growing within 2 weeks of infection, turn a dull purplish yellow, and soon die.

ARS plant geneticist Mark W. Martin (H. Rodgers Hamilton Laboratory, Prosser, WA 99350) developed the new tomato varieties. He screened more than a million plants of at least 25,000 different lines, evaluating each for curly top resistance and horticultural type.

In addition to being resistant to curly top, the new varieties—Roza, Columbia, Rowpac, and Saladmaster—are also resistant to verticillium and fusarium wilts, foliage diseases, and root rots. All are high-acid tomatoes suitable for home canning and all resist cracking.

The new varieties are especially suited for home gardeners and small farmers who sell tomatoes through roadside stands and local markets. Roza, Columbia, and Rowpac do best when seeded directly into the garden or field, but can be transplanted. Saladmaster performs better if transplanted.

Seeds for planting have been made available to the public this year. All home and market gardeners interested in obtaining seeds for trial plantings should be able to do so.—*L. C. Y.*

Cheese for a mouse . . .

. . . but what for a louse? Rearing and maintaining a colony of insects for experiments pose a number of tricky problems, and finding a diet that is both readily available and consistent in quality is one of them.

That problem has been solved for colonies of three species of biting lice. ARS technician Donald E. Hopkins, along with entomologist William F. Chamberlain and technician Alan R. Gingrich, U.S. Livestock Insects Laboratory (Kerrville, TX 78028) found in recent tests that the lice do very well on a diet of several commonplace ingredients.

Previously, lice colonies have been maintained on skin preparations of their natural hosts. The skins are not only hard to get, but diets prepared from them are nutritionally inconsistent.

After testing several diets for each species, the researchers concluded that the most useful diets were:

- dehydrated veal and wool extract, 4 to 1 ratio, for the hairy goat biting louse, *Bovicola crassipes* (Rudow).
- dehydrated veal and dehydrated lanum, 3 to 1 ratio, for the Angoragoat biting louse, *B. limbatus* (Gervais).
- dehydrated veal and wool extract, 3 to 1 ratio, for the sheep biting louse, *B. ovis* (Schrank).

Good results were obtained for other diets for the hairy goat biting louse and the Angoragoat biting louse; for the sheep biting louse, however, only the above-mentioned diet was satisfactory.

Lice from already established colonies did better on the new diets than did field-collected lice. It would be possible, however, to establish and maintain colonies of field-collected lice on the new diets.

The long-term feasibility of the diets is demonstrated by the fact that the three species have been thriving on the new diets for well over a year.—*B. D. C.*

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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AGRISEARCH NOTES

Dwarf attacks sorghum

A CRIPPLING NEW DISEASE of sweet sorghum, reported in the United States for the first time, causes 50 percent dwarfing—the plants grow only half as tall. The disease is terminal; stunted plants rarely produce seed heads and those produced are completely barren. Leaves are rigid, curled, and bunched together at the top of the stalks.

The disease, yellow sorghum stunt, is conspicuous at a distance for its yellow-tinged cream color. When first observed in 1966, only individually affected plants were found. Now it has spread to most sweet sorghum-growing areas including Alabama, Georgia, Kentucky, Louisiana, Mississippi, Ohio, and Texas.

Plant pathologist Natale Zummo and research agronomist Kelly Freeman of the U.S. Sugar Crops Field Station (Route 10, Box 152, Meridian, MS 39201) report the incidence of the disease to be greater in border rows than in the center of fields, suggesting an insect-transmitted agent. Transmission tests, infecting healthy plants by means of common insect vectors of maize dwarf mosaic virus and corn stunt, produced no symptoms.

Sweet sorghum varieties such as MN1056, Roma, and Ramada were extremely susceptible and severely injured when infected. Rio, Brandes, and Sart were less susceptible. The disease was also found in grain sorghum.

Cause of yellow sorghum stunt is still largely undefined. Electron microscopy using leaf tissue of stunted sorghum plants revealed both mycoplasma-like bodies and maize chlorotic dwarf virus. Mycoplasma resemble bacteria without cell walls. They differ from viruses in that they are potentially capable of reproduction outside of host cells.

These mycoplasma-like bodies were found in the phloem tissue cells which conduct nutrients.

Maize chlorotic dwarf virus was detected by the presence of inclusions, subcellular structures caused by the virus.

Scientists concluded that the strong association of mycoplasma-like bodies with yellow sorghum stunt symptoms indicate a mycoplasma-like agent is responsible for the disease.

With the small sample size used for electron microscopy at the Ohio Agricultural Research and Development Center at Wooster, other disease agents could be present, says Dr. Zummo, but not detected.

The means of transmission is still to be determined.

Dr. Zummo and Mr. Freeman worked cooperatively in the sorghum stunt research with the Mississippi Agricultural and Forestry Experiment Station and with Dr. Oscar E. Bradfute and Dr. Diane C. Robertson at the Ohio research center.—*P. L. G.*

TCP suppresses insects

TRICALCIUM PHOSPHATE (TCP), a mineral food additive known to be beneficial to humans, can also suppress insect populations.

These are the findings of entomologists James E. Baker and Henry A. Highland, Stored-Product Insects Research and Development Laboratory (Box 5125, Savannah, GA 31403), who are studying ways of controlling insects that infest flour and other grain products which are frequently stored over long periods.

At this point in their research the scientists are unable to ascribe any chemical action on the part of TCP in killing insects but rather suspect that it kills them by dehydration.

There appears to be some inhibitory effect on larval growth rate, but recovery is apparently complete when a different diet is offered.

The scientists believe the mode of action of TCP may be similar to that of inert dusts which both abrade the insects' cuticle (skin-like outer covering) and absorb cuticular lipids resulting in lethal moisture losses.—*V. R. B.*

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